Not to be cited without
permission of the authors[1]

Ne pas citer sans
autorisation des auteurs[1]

DFO Atlantic Fisheries
Research Document 95/105

MPO Pêches de l'Atlantique
Document de recherche 95/105

Status of the Rocky and Little River Atlantic salmon (Salmo salar L.) stocks in 1994

by

C. E. Bourgeois and J. P. Davis
Science Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's, Newfoundland A1C 5X1

[1]This series documents the scientific basis for the evaluation of fisheries resources in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the secretariat.

[1]La présente série documente les bases scientifiques des évaluations des ressources halieutiques sur la côte atlantique du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

Abstract

The Rocky River has been undergoing an Atlantic salmon colonization program and has been stocked from 1984-1987 with unfed fry and with adult salmon in 1987. Little River is a sea ranching project which was stocked with unfed fry from 1990-1994. The 1994 smolt to adult figure for Rocky River was 2.4%. Escapement to both watersheds was down from the previous year. The Rocky River egg deposition was estimated to be 30% of target. The Little River egg deposition was estimated to be 38% of target.

Résumé

Un programme d'implantation du saumon de l'Atlantique a été entrepris dans la rivière Rocky, qui a été empoissonnée de 1984 à 1987 d'alevins non alimentés et, en 1987, de saumons adultes, tandis qu'une opération de pacage marin dans la rivière Little a été approvisionnée en alevins non alimentés de 1990 à 1994. Le taux de survie entre le stade de saumoneau et celui d'adulte était de 2,4 % dans la rivière Rocky. L'échappée de reproducteurs dans les deux bassins hydrographiques était en baisse par rapport à l'année précédente. On estimait la ponte à 30 % de la cible dans la rivière Rocky et à 38 % de la cible dans la rivière Little.

Introduction

The Rocky River is the largest watershed on the Avalon Peninsula, encompassing a drainage area of 296 km^2 (Porter et al. 1974) flowing to the sea in SFA 9 (Fig. 1). A natural falls at the mouth of this river, overcome by fishway construction, made this watershed inaccessible to anadromous Atlantic salmon, prior to 1987. The Rocky River requires 3.4 million eggs to meet its target deposition (Table1).

The Little River flows into the Bay d'Espoir in SFA 11(Fig. 1) approximately 4 km south of the Conne River. The watershed encompasses 183 km^2 with a complete obstruction at kilometre 4.8 on the main stem of the river which results in anadromous Atlantic salmon having access to less than 30% of the watershed. The Little River requires 313,920 eggs and 976,072 eggs for the accessible and inaccessible portions of the watershed respectively (Table 1).

The intent of this document is to review the status of these stocks in 1994 and to discuss any possible changes in stock status due to management changes affecting marine exploitation.

Background

For details of the stocking conducted on these watersheds refer to Tables 3 and 4. The Rocky River, during its stocking phase, received between 23%-64% of its target egg requirement and since that time returns have provided 20%-47% of target egg deposition.

Both watersheds are closed to recreational salmon fishing.

Management changes implemented in 1992 which were in place in 1994 that impacted marine exploitation of salmon are as follows:

1. Moratorium on commercial salmon fishing along the coast of insular Newfoundland.

2. Moratorium on the cod fishery in areas 2J, 3K and 3L implemented on July 15, 1992. This removed all cod traps from these NAFO areas.

Methods

Biological characteristic data, habitat determinations, and target spawning requirements are those determined by Bourgeois et al. (1992) and Bourgeois et al. (1994).

Target egg requirement was calculated based on 240 egg/m^2 of fluvial habitat and 7 smolts/ha of standing water. Smolt production of 7 smolt/ha was divided by 1.9% to convert this to eggs, (O'Connell et al., 1991).

In order to calculate the egg deposition in areas where stocking occurred, an estimate of egg-to-fry survival of 20% (Sturge, 1968) was used. The number of fry released was back calculated to indicate an quivalent number of eggs naturally spawned to produce those fry. Sturge (1968), in his work, gave a range of 10-30% for egg-to-fry survival and indicated that a figure of 20% appeared to be a reasonable value.

Spawning escapement was calculated from fishway/fence counts (no recreational fisheries on these systems) without inclusion of an estimate for poaching and disease.

Results and Discussion

Rocky River

Tables 1 and 2 details the accessible rearing area, target egg deposition and biological characteristics, respectively for the Rocky River. The use of fixed parameters, such as 2.4 eggs m^2 and 7 smolts/ha of standing water, has certain limitations (see O'Connell & Dempson, 1991 for discussion on this topic).

The 1994 total returns to the Rocky River was only 48.6% of the 1993 total returns and 60% of the previous 5 year mean. A large part of the decline in escapement can be attributed to the low smolt production in 1993 and the lowest smolt to adult survival recorded to date(Fig.2). The 1994 escapement would have accounted for 37% of the required egg target , however another enhancement phase was initiated in 1994 and the exact egg deposition cannot be calculated untill subsequent egg products are stocked in 1995.

Table 5 details smolt enumeration and age structure of the 1990-94 escapement. The 1994 adult returns were all resultant from natural spawning. Smolt to adult returns to the river were 2.5%, 3.1%, 4.1% and 2.4% for 1990-93 smolts, respectively. Smolt to adult survival is calculated based on the portion of virgin fish

in the escapement. The increase from 1990 to 1991 and 1992 can, in part, be attributed to the moratorium. The decrease in the 1993 smolt survival is most likely due to a decrease in marine survival.

Table 6 provides insight into the egg/fry-to-smolt survival on the Rocky River. The egg-to-smolt figures compare favourably to other watersheds. At present it appears that egg to smolt survival has declined since 1989. The increase in the 1994 smolt count is due to the high egg deposition in 1990 rather than an increase in egg to smolt survival.

Repeat spawners accounted for 16.7%, 7.7%, 12.5% , 9.4% and 32.3% of the returns to Rocky River for the years 1990-94 respectively.

Nineteen fish were sacrifiiced and examined for fecundity from Rocky River in 1994 and the relationship between total eggs and fork length is displayed in Fig. 3. The study revealed an average of 1813 eggs/kg as opposed to the figure of 2,066 which is presently being used.. These new results will be incorpriated in the 1995 stock status report to allow for collection of more data as the results will affect the percentage of target egg achieved.

The 1995 escapement to Rocky River in 1995 is expected to be in the order 234-318 virgin grilse plus repeat spawners based on the range of smolt to adult survival data collected to date.

Little River

Table 1 details the available habitat and target egg deposition for the Little River watershed. The data is presented for the area above and below the obstruction as fish passage is impossible and stocking occurs above the falls. Table 4 details the egg deposition rates for the watershed with the 1994 fence count being only 48.8% of the 1993 count and 68.2% of the previous five year mean. Egg deposition on the Little River is the lowest on record since 1988.

The 1993 smolt run was comprised of fish that were 32.7%, 58.1% and 9.3% river ages 2^+, 3^+ and 4^+, respectively. The corresponding adults revealed 8.6%, 88% and 3.4%, 2^+, 3^+ and 4^+ river ages respectively. The 1994 escapement was comprised of 11.3% repeat spawners.

Table 7 details the dates of counting fence operation and the number of smolt and parr enumerated for 1992-93. Of interest is the large number of parr enumerated at the fence each year. The fence site is located approximately 1 km upstream of the river mouth but is under tidal influence. This is suggestive that these parr are smoltifying downstream of the fence site.

Smolt to adult survival figures are not calculated as they are not likely indicative of the entire smolt output.

References

Bourgeois, C. E., J. P. Davis, and J. O'Brien. 1992. Atlantic salmon (*Salmo salar* L.) target spawning requirements and status of the Rocky River stock 1983-1991. CAFSAC Res. Doc. 92/10. 7p.

Bourgeois, C. E., J. P. Davis, and J. O'Brien. 1994. Status of the Little River stock of Atlantic salmon(*Salmo salar* L.) in 1993. DFO Atlantic Fisheries Res. Doc. 94/72.

O'Connell, M. F., and J. B. Dempson. 1991. Atlantic salmon (*Salmo salar* L.) target spawning requirements for rivers in Notre Dame Bay (SFA 4), St. Mary's Bay (SFA 9), and Placentia Bay (SFA 10), Newfoundland. CAFSAC Res. Doc. 91/18. 14 p.

O'Connell, M. F., J. B. Dempson, and R. J. Gibson. 1991. Atlantic salmon (*Salmo salar* L.) smolt production parameter values for fluvial and lacustrine habitats in insular Newfoundland. CAFSAC Res. Doc. 91/19. 11 p.

Porter, T. R., L. G. Riche, and G. R. Traverse. 1974. Catalogue of rivers in insular Newfoundland. Vol. D. Resource Development Branch, Newfoundland Region. Data Record Series No. NEW/D-74-9: 353 p.

Sturge, C. C. 1968. Production studies of the young stages of Atlantic salmon (*Salmo salar* L.) in an experimental area of Indian River, Notre Dame Bay, Newfoundland. M.Sc. Thesis, Dept. Biology, Memorial University of Newfoundland. 134 p.

Table 1: Rearing area and target egg deposition for Rocky and Little Rivers.

	Riverine habitat (m^2)	Lacustrine habitat (ha^2)	Target egg deposition
Rocky River	10,823	2,191	3,404,730
Little River			
accessible	230	0	313,920
inaccessible	688	27	939,120
total	918	27	1253040

Table 2. Biological characteristics for the Rocky River stock.

Year	No. Sampled	Mean Length (sd)	MeanWeight (sd)	% Repeats	Sex Ratio
1990	21	57.1 (3.8)	2.2 (0.3)	14	*
1991	32	56.9 (3.9)	2.2 (0.5)	9	*
1992	24	58.0 (6.0)	2.4 (0.5)	17	*
1993	32	56.5 (4.5)	2.2 (0.5)	13	*
1994	68	56.9 (4.3)	2.0 (0.4)	31	79% female

* no data available

Table 3. Details of egg deposition Rocky River 1983-94.

Year	No. Released Fry	Fry to Egg Equiv.	Released Adults	Fishway Count large	Fishway Count small	Broodstock	Total Eggs	% Target Egg
1983	0	1538875	0			0	1538875	45
1984	307775	2172500	0			0	2172500	64
1985	434500	970000	0			0	970000	28
1986	194000	1998225	0			0	1998225	59
1987	399645	0	124	80	1	0	799687	23
1988	0	0	0	313	6	0	1232431	36
1989	0	0	0	168	9	0	683825	20
1990	0	0	0	401	17	0	1614910	47
1991	0	0	0	211	16	0	876996	26
1992	0	0	0	237	46	0	1093348	32
1993	0	0	0	292	72	0	1406285	41
1994	0	0	0	158	19	62	1008973	30

Note: The 1994 egg deposition is preliminary as 1995 stocking will affect it.

Table 4. Egg deposition rates for Little River 1987-93.

Year	Fence Count		Spawning escapement	Fry stocked	Fry Stocked	Egg Equiv.	Egg Equiv.	Natural Egg	% Target	Total	% Target	% Target
	large	small		Below Falls	Above Falls	Below Falls	Above Falls	Deposition	Wild	Eggs	Below Falls	Above Falls
1987	64	3	67	0	0	0	0	91,410	29.12%	91,410	29.12%	0.00
1988	65	3	68	0	0	0	0	92,774	29.55%	92,774	29.55%	0.00
1989	102	5	66	0	0	100,350	0	90,046	28.68%	190,396	60.65%	0.00
1990	158	15	91	20,070	0	204,835	0	124,154	39.55%	328,989	104.80%	0.00
1991	55	6	31	40,967	0	103,715	0	42,294	13.47%	146,009	46.51%	0.00
1992	104	21	28	20,743	0	102,835	553,380	38,201	12.17%	694,416	44.93%	56.69
1993	169	11	80	20,567	110,676	148,090	444,270*	109,146	34.77%	701,506	81.94%	45.52
1994	73	11	88	29,618	88,854	0	0	120,061	38.25%	120,061	38.25%	0.0

Table 5. Details of smolt enumeration 1990-94.

Year	Smolt Count	Percentage at Age			
		2^+	3^+	4^+	5^+
1990	8,287	1	66	29	4
1991	7,732	16	70	13	1
1992	7,813	1	76	21	2
1993	5115*	13	57	24	6
1994	9781	2	66	29	3

* Smolt count is an estimate due to fence washout

Table 6. Details of egg/fry to smolt survival 1985-90.

Year	egg to smolt survival (%)	fry to smolt survival (%)	smolt classes
1985		0.08	5^+
1986		1.3	$4^+, 5^+$
1987		1.6	$3^+, 4^+, 5^+$
1987	0.93		$2^+, 3^+, 4^+, 5^+$
1988	0.71		$2^+, 3^+, 4^+, 5^+$
1989	0.85		$2^+, 3^+, 4^+$
1990	0.44		$2^+, 3^+$
1991	0.0002		2^+

Table 7. Details of smolt and parr enumeration Little River.

Year	Dates of Operation	Number of Smolt	Number of Parr
1992	May 11-July 5	382	1,404
1993	May 11-July 5	324	1,500
1994	May 6- June 13	495	4,018

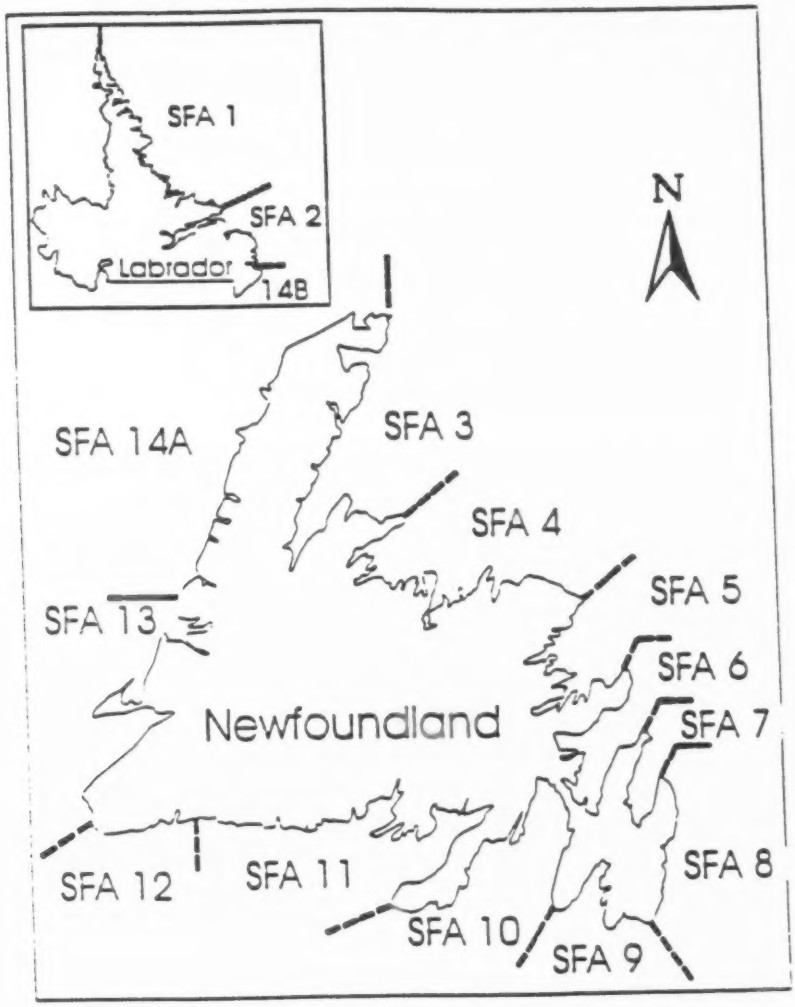

Fig. 1. Map showing the 14 Salmon Fishing Areas of the Newfoundland Region.

Rocky River

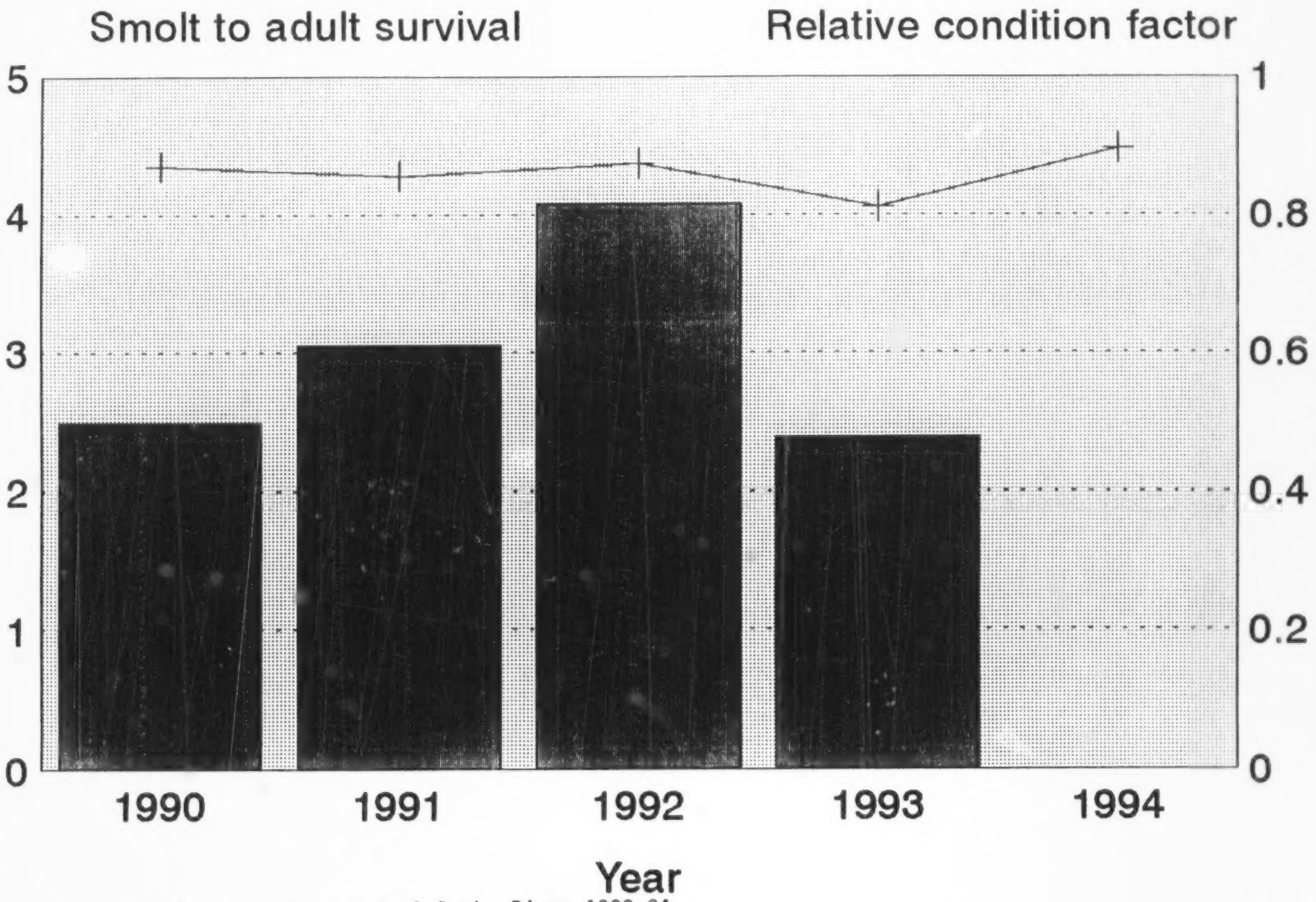

Fig. 2. Smolt to adult survival Rocky River 1990-94.

Rocky River Fecundity

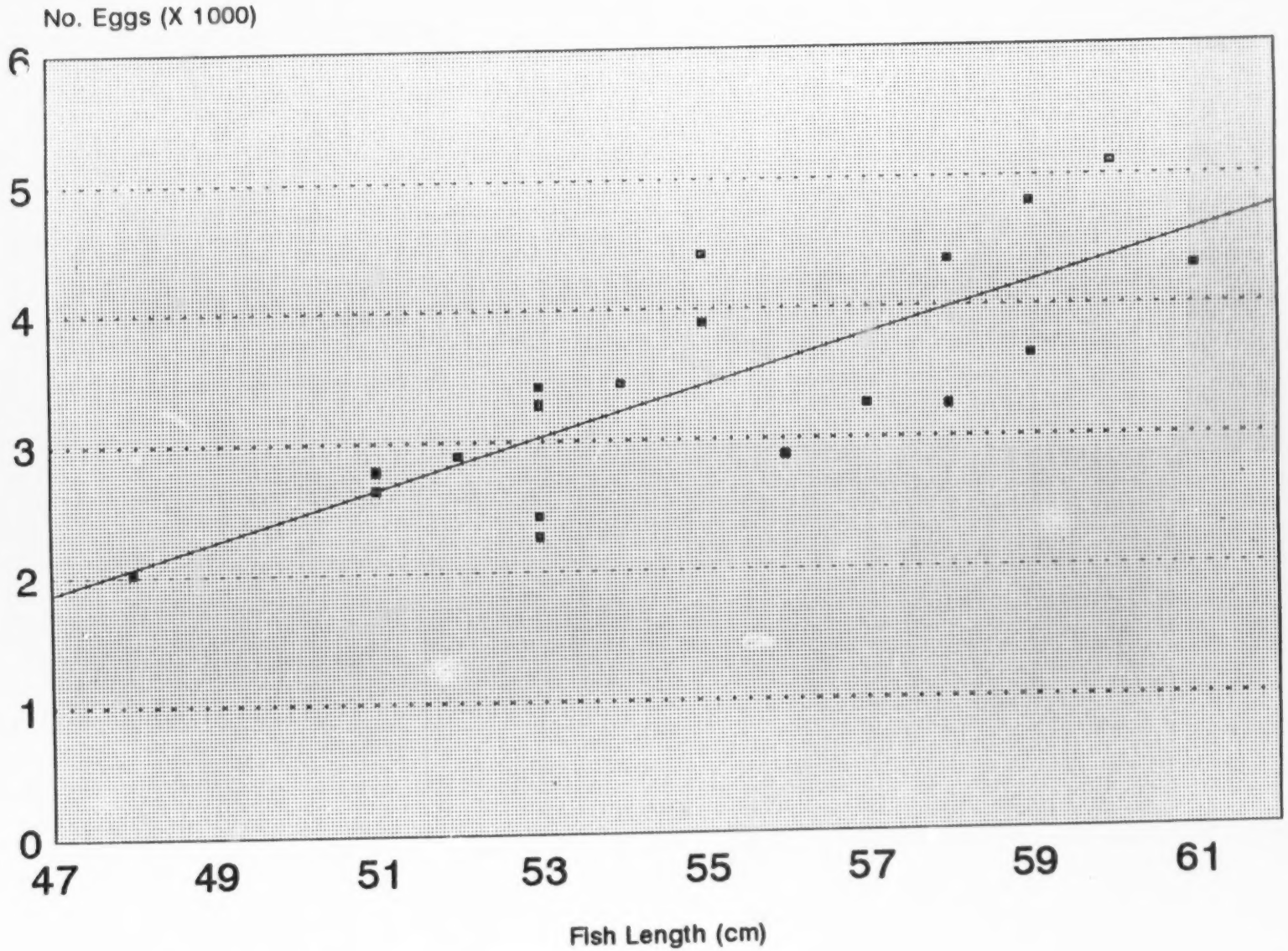

Fig. 3. Rocky River fecundity.